# BULK ASBESTOS SPECIFIC OPERATIONS CHECKLIST

**Instructions to the Assessor:** This checklist addresses specific accreditation criteria prescribed in applicable sections of Handbook 150-3.

Place an "X" beside any of the checklist items which represent a deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments on this list or on the comment sheet(s). Place a check beside all other items you observed or verified at the laboratory.

## 1 Organization and management

See General Operations Checklist

## 2 Quality system, audit and review

_____ 2.1 The laboratory shall ensure that the quality assurance analyses represent at least 10% of the total number of analyses performed.

_____ 2.2 The laboratory shall maintain and summarize all of the quality assurance activities each month to include:

- _____ contamination checks using asbestos-free material, such as the glass fiber blank in SRM 1866;
- _____ internal and NIST proficiency testing for each analyst;
- _____ interlaboratory analyses;
- _____ overall accuracy and precision for each microscopist for qualitative and quantitative analyses as defined in its quality documentation;
- _____ identification of any sample custody errors, such as mixing up samples, losing samples, etc.;
- _____ comparison of results of independent techniques with PLM results, if appropriate;
- _____ deficiency corrections;
- _____ an estimate of the total failure rate of the laboratory based on combination of all errors above.

_____ 2.3 The laboratory shall have the following documents available:

_____ NIST Handbook 150;
_____ U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" as found in 40 CFR, Part 763, Subpart F, Appendix A, or the current U.S. Environmental Protection Agency method for the analysis of asbestos in building materials;
_____ AHERA - 40 CFR Part 763, Vol. 52, No. 210: "Asbestos Containing Materials in Schools; Final Rule and Notice";
_____ reference text(s) on optical mineralogy and crystallography;
_____ general reference text(s) on statistics and quality assurance;
_____ U. S. Environmental Protection Agency's "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116), July 1993, R.L. Perkins and B.W. Harvey.

_____ 2.4 The laboratory's quality documentation contains procedures or instructions describing the following:

_____ training of staff and quality assurance of analyst performance;
_____ sample custody and handling procedures;
_____ analysis of samples and methods to ensure the accuracy and precision of analyses;
_____ equipment maintenance and calibration of refractive index liquids;
_____ contamination control;
_____ record keeping and generation of reports.

_____ 2.5 The laboratory shall have a description of its staff training program including its criteria for successful completion. The training program shall include training with blanks and blind testing to determine competency. New analysts' results shall be checked by either an experienced analyst (with an acceptable error rate) or by an independent technique until the analyst has an acceptable error rate. Analysts and technical supervisors shall participate in some form of continuing education, such as formal course work, in-house education, and scientific or technical meetings, and have access to journals that describe advances in the field of microscopy and/or asbestos analysis.

_____ 2.6 The laboratory shall conduct an internal audit of the laboratory not less than annually to verify that the operations of the laboratory are in compliance with its quality manual and this program.

**3 Personnel**

_____ 3.1 The laboratory shall ensure that staff members are aware of the extent of their area of responsibility.

_____ 3.2 The laboratory shall ensure that:

_____ analyst(s) have an understanding of and can measure the index of refraction by the immersion method;

_____ analyst(s) understand polarized light microscopy sufficiently to conduct analyses. They understand what the various optical properties are, how they are measured or observed in the microscope, and how the data are used to form a conclusion about the identity of the component. (e.g., an analyst using focal screening (dispersion staining) to measure refractive index must be able to explain what produces the observed color and how that color is used to determine refractive index);

_____ analyst(s) are competent with the polarized light microscope. They can properly align the microscope and identify all the crucial parts;

_____ analyst workload is consistent with accurate and precise analytical measurement;

_____ technical supervisor(s) shall have a fundamental knowledge of the method to assure the quality of the laboratory's results.

_____ 3.3 The laboratory shall maintain documentation for each staff member which contains:

_____ staff member's title and description of that job position;

_____ job and quality assurance responsibilities;

_____ résumé;

_____ training;

_____ assigned laboratory procedures and duties;

_____ results of quality assurance activities including precision and accuracy, and the results of NVLAP proficiency testing;

_____ accuracy, precision and error data;

_____ correction of deficiencies.

**4 Accommodation (facilities) and environment**

_____ 4.1 The laboratory has the proper facilities, including space, lighting, environmental control, etc. to perform analyses and store asbestos adequately.

_____ 4.2 The laboratory uses blanks of asbestos-free material to determine the presence, quantity, and consistency of asbestos contamination in their analytical process and has related procedures to control it.

## 5 Equipment and reference materials

_____ 5.1 The laboratory shall have the following equipment and materials:

- _____ biohazard hood of Class I or with a HEPA filter;
- _____ sampling utensils, (scalpels, forceps, probes, needles, tweezers, razors, etc.);
- _____ microscope slides and cover slips;
- _____ refractive index liquids, 1.490-1.570 and 1.590-1.720 in increments of less than or equal to 0.005 (high dispersion liquids are optional);
- _____ stereomicroscope or low power binocular microscope, approximately 10-45X, with light source;
- _____ mortar and pestle;
- _____ sample containers (ceramic bowls, glass plates, petri dishes, glassine paper, etc.);
- _____ thermometer.

_____ 5.2 The laboratory shall have a polarized light microscope (PLM) with:

- _____ binocular or monocular with cross hair reticle (or functional equivalent);
- _____ low ($\geq$5X and $\leq$15X), medium ($>$15X and $<$40X), and high ($\geq$40X) objectives;
- _____ light source;
- _____ 360-degree rotatable stage;
- _____ substage condenser with iris diaphragm;
- _____ polarizer and analyzer that can be placed at 90° to each other;
- _____ accessory slot at 45° to polarizers for wave plates and compensators;
- _____ wave retardation plate ($\sim$ 550 nm retardation);
- _____ dispersion staining objective complete with accessories (optional);
- _____ test slide (or a standard such as SRM 1866) for aligning the cross hairs with the privileged directions of the polarizer and analyzer.

_____ 5.3 The laboratory shall ensure that each microscope is in proper working condition. The optical system, including objectives, condensers, polarizers, etc., are not damaged or modified in any way that would affect microscope resolution or depolarize the light. (i.e., the lens is relatively free of scratches, nicks, corrosion, signs of impact, etc., and there is no stop in the back focal plane other than for dispersion staining objectives).

_____ 5.4 The laboratory shall align the polarized light microscope daily (or prior to use) in such a way that:

- _____ the substage polarizer and the analyzer are oriented at 90 degrees to one another. The orientations of the privileged directions of the polarizers must be known. The accessory slot must be at 45 degrees to these privileged directions;
- _____ the ocular cross hairs coincide with the privileged directions of the polarizer and the analyzer and this condition is verified with a test slide (or similar standard);
- _____ the objectives and/or stage are centered to prevent any grains from leaving the field of view during stage rotation;
- _____ the condenser and iris diaphragm are centered on the optic axis.

_____ 5.5 The laboratory has reference materials for chrysotile, amosite, crocidolite, tremolite, actinolite, anthophyllite and glass fiber traceable to NIST (SRM 1866 and SRM 1867).

*Note: These SRMs are available from the NIST Standard Reference Materials Program (SRMP), Room 204, Building 202, NIST, Gaithersburg, MD 20899, 301-975-6776.*

_____ 5.6 The laboratory has calibrated refractive index solids or refractometer (or access to) for calibrating refractive index liquids.

_____ 5.7 The laboratory shall have written procedures for calibrating refractive index liquids:
- _____ frequently enough to ensure reliable calibration;
- _____ within an accuracy of ±0.004;
- _____ including room temperature measurement of ±2 °C.

_____ 5.8 The laboratory maintains the necessary equipment for any optional procedure(s) it performs.

## 6 Measurement traceability and calibration

_____ 6.1 The laboratory shall have an error rate of less than 1% on the qualitative analysis (asbestos present or not and type) of samples containing greater than trace amounts of chrysotile, amosite, or crocidolite.

_____ 6.2 The laboratory shall identify problem samples, such as floor tiles, that are difficult to analyze qualitatively and shall have specific procedures to deal with the problem samples to reduce the errors to less than 1%.

_____ 6.3 The laboratory shall have procedures describing how reference standards are used to verify the accuracy of an analyst's ability to correctly determine the optical properties of asbestos.

_____ 6.4 The laboratory determines precision on the qualitative and quantitative analyses of samples by:
- _____ repeat analyses by the same analyst;
- _____ comparison of results from multiple slide mounts of the same material;
- _____ analysis of samples by multiple analysts if possible (single analyses laboratories require more interlaboratory data);
- _____ analysis of samples by other laboratories.

_____ 6.5 The laboratory determines the accuracy of the qualitative and quantitative analyses of samples by:
- _____ analysis of proficiency testing materials;
- _____ analysis of standards either prepared in-house or purchased;
- _____ analysis of samples using independent methods (XRD, gravimetry, etc).

_____ 6.6 The laboratory uses blanks of asbestos free material to test for contamination.

_____ 6.7 The laboratory keeps control charts showing the results of precision and accuracy tests.

_____ 6.8 If an estimation technique that is equivalent to point counting is used, the laboratory:

_____ 6.8.1 uses one or more of the following for calibration:

_____ bulk standards;
_____ prepared (permanent) slides that have been point-counted;
_____ photomicrographs of grain mounts that have been calibrated for relative area;
_____ other appropriate standards;

_____ 6.8.2 has data to show equivalency to point counting.

**7 Test methods and calibration**

_____ 7.1 The laboratory uses the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" as found in 40 CFR, Part 763, Subpart F, Appendix A, or the current U.S. Environmental Protection Agency method for the analysis of asbestos in building materials.

_____ 7.2 The laboratory shall have a clear definition of each asbestos type that includes the acceptable optical properties (e.g., such as the range in refractive indices), that the fibers can exhibit and still be identified as the particular asbestos type, and what constitutes asbestiform morphology.

_____ 7.3 The laboratory shall determine the identification of fibrous materials by the measuring the following optical properties:

_____ morphology;
_____ color and pleochroism;
_____ indices of refraction ($n_D$) parallel and perpendicular for chrysotile, amosite, crocidolite; $\gamma$ and $\alpha$ for anthophyllite, actinolite, and tremolite if they display biaxial optics;
_____ birefringence;
_____ extinction characteristics;
_____ sign of elongation.

_____ 7.4 The laboratory shall have a written procedure for dealing with samples in which the fibers are heavily coated with binder that hinders analysis.

_____ 7.5 The laboratory must maintain a list of non-asbestos fibers that can be confused with asbestos and the specific optical properties for each that can be used to distinguish between asbestos and non-asbestos.

_____ 7.6 The laboratory shall measure and record at least one optical property for non-asbestos fibers that serves to distinguish them from asbestos.

_____ 7.7 The laboratory shall have specific sample preparation techniques for dealing with samples that are semi- or non-friable.

_____ 7.8 The laboratory shall use the point-count technique or a technique that it has demonstrated and documented to be equivalent for quantitative analysis.

_____ 7.9 The laboratory shall homogenize the sample in some way or analyze a sufficient number of subsamples to obtain a representative analysis.

_____ 7.10 The laboratory shall have a working definition of trace and be able to distinguish between trace concentrations of asbestos and concentrations near 1%.

## 8 Handling of calibration and test items

_____ 8.1 The laboratory shall have a sample log system used to uniquely identify the test item and document the action. The log shall include:

- _____ date of receipt of the test item;
- _____ the condition of the test item;
- _____ documentation of acceptance or rejection of test item, reasons for rejection (e.g., air samples mixed with the bulk samples);
- _____ a unique laboratory identification number for each test sample;
- _____ the client identification number, which is the number that the client (or sample taker) assigns to the test item;
- _____ the initials of the person making the above entries in the sample log book.

_____ 8.2 Where there is any doubt as to the test item's suitability for testing (e.g. too small of a sample size, a mismatch between identification and description, or whether they are of a type which can be analyzed by the laboratory), the laboratory shall have a procedure for informing the client and resolving the problem. This action shall be documented.

_____ 8.3 The laboratory shall:

- _____ have written procedures to ensure that bulk samples are stored safely and securely;
- _____ dispose of bulk samples in a safe manner and in accordance with any and all federal, state and local regulations;
- _____ document the disposal/return of bulk samples and retain the documentation with all other data and information regarding the sample;
- _____ properly store materials to prevent damage or cross contamination;
- _____ hold samples for a minimum of 30 days after analysis unless earlier return is requested by the client or prevented by law or regulation.

## 9 Records

_____ 9.1 The laboratory shall have a description of the laboratory's record-keeping system.

_____ 9.2 The laboratory shall have documentation, either electronic backup or "paper" hard copy, to verify survival of original data if computers are used for data retention.

_____ 9.3 The laboratory maintains in its records all the required optical data for each analysis that it performs.

_____ 9.3.1 The laboratory records the following stereomicroscopical data for bulk examination to include:

_____ homogeneity;
_____ texture;
_____ color;
_____ estimated concentration of asbestos.

_____ 9.3.2 The laboratory records the following data for the asbestos type(s) by PLM examination:

_____ morphology;
_____ color and pleochroism;
_____ indices of refraction ($n_D$) parallel and perpendicular for chrysotile, amosite, crocidolite; $\gamma$ and $\alpha$ for anthophyllite, actinolite, and tremolite if they display biaxial optics;
_____ birefringence;
_____ extinction characteristics;
_____ sign of elongation;
_____ estimated concentration of asbestos;
_____ result of analysis.

_____ 9.4 The laboratory shall ensure that the analyst signs (or initials) and dates the original data.

_____ 9.5 The following records are maintained for a minimum of 3 years:

_____ sample custody;
_____ original data collected by analyst;
_____ contamination monitoring data;
_____ calibration and verification data;
_____ quality control activities and results;
_____ equipment and maintenance;
_____ test reports.

## 10 Certificates and reports

_____ 10.1 Each report shall include the following information:

_____ color (and any other information that serves to macroscopically identify and describe the sample);
_____ presence or absence of asbestos;
_____ type or types of asbestos present;
_____ estimate of the area percent for each type of asbestos present;
_____ identity of other fibrous materials (if known);
_____ estimate of the area percent for other fibrous materials present (if known);
_____ identity of matrix materials if known;
_____ a statement is made if the sample is inhomogeneous and if subsamples of the components were analyzed separately;
_____ a description of any problems encountered in the analysis;
_____ departures from the test method;
_____ an approved signatory's signature.

_____ 10.2 The laboratory shall report the results of samples containing one or more layers consistent with the most current guidelines.

_____ 10.3 The laboratory shall ensure that the client receives a "hard copy original" of the test report by mail, notwithstanding initial transmittal by facsimile, telex or other electronic means.

## 11 Subcontracting of calibration or testing

See General Operations Checklist

## 12 Outside support services and supplies

See General Operations Checklist

## 13 Complaints

See General Operations Checklist

## 14 Proficiency testing

_____ The laboratory shall participate in the mandatory NVLAP Proficiency Testing program, which includes (but is not limited to) the following:

- _____ analyses are not contracted out to another laboratory;
- _____ laboratory keeps and utilizes proficiency testing materials for use as in-house instructional materials;
- _____ all analysts (full and part time) participate in all proficiency testing rounds (all analysts need not participate in proficiency testing prior to returning the results to NVLAP, but all analysts shall participate without prior knowledge of the testing results at a later date);
- _____ each analyst separately analyzes, records and reports test results;
- _____ one single result is reported back to NVLAP by the laboratory unless otherwise specified in the testing instructions;
- _____ procedures and calculations (if any) are documented as to how the one single result was determined;
- _____ problems indicated by proficiency testing are discussed with appropriate laboratory personnel and documented;
- _____ plans are developed and implemented for resolving problems and are documented;
- _____ the test results are used in determining accuracy and precision for each analyst.

## 15 Sub-facilities

_____ 15.1 The sub-facility **is technically dependent** on the main facility (i.e., technical management and supervision are provided by the main facility.

_____ 15.2 Quality assurance activities of the sub-facility are directed by the main facility.

_____ 15.3 The nature, scope, and frequency of on-site quality assurance reviews, by the main facility quality manager (or equivalent), are:

- _____ clearly defined in the quality manual;
- _____ appropriate for the nature and scope of work performed by the sub-facility.

_____ 15.4 All permanent quality assurance and personnel records are retained at the main facility.

_____ 15.5 Quality assurance data from each sub-facility are regularly and routinely compared both to the main facility's data and data from other sub-facilities. Records of such comparisons are retained in quality assurance records along with actions taken to evaluate and resolve differences.

_____ 15.6 Analysts at sub-facilities participate in NVLAP proficiency testing and records are maintained of individual results.

## SPECIFIC OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

**Instructions to the Assessor:** Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

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